Motta: On light-water reactor materials

A new textbook published by the American Nuclear Society describes the fundamentals of the behavior of nuclear materials in light-water reactors.

Light Water Reactor Materials, Volume I: Fundamentals was recently published by the American Nuclear Society. Volume I, which covers both the materials science and nuclear engineering topics needed to understand the behavior of materials inside a nuclear reactor, will be accompanied by a second volume that focuses on applications. The book’s authors are Arthur Motta, a professor of nuclear engineering at Pennsylvania State University, and Donald Olander, professor emeritus at the University of California at Berkeley.

Motta, a native of Brazil, says that his journey to a career in the nuclear industry started after high school in 1975 when he looked to major in physics in college. He was prompted by his parents, however, to study engineering as a better path to job opportunities. Motta entered the mechanical engineering program at the Federal University of Rio de Janeiro, but he still felt the tug of science. The engineering program offered a specialization in nuclear engineering, and so he pursued it because it connected him back to physics. Motta received a bachelor’s degree in mechanical engineering in 1980 and a master’s degree in nuclear engineering in 1983. He then came to the United States to study at the University of California at Berkeley, where he worked under the guidance of Professor Olander and received a doctorate in nuclear engineering in 1988.

After receiving his Ph.D., Motta worked for two years as a research associate at the French Atomic Energy Commission’s Center for Nuclear Studies in Grenoble, and for a year as a postdoctoral fellow at Atomic Energy of Canada Limited’s Chalk River Laboratories. He joined the Penn State faculty in 1992 and went on to become chair of the university’s Nuclear Engineering Program in the Department of Mechanical and Nuclear Engineering.

Motta: “The study of nuclear materials brings together knowledge from many different disciplines, such as chemistry, thermodynamics, materials science, and thermal hydraulics.”
Motta is a Fellow of the American Nuclear Society, and in 2015 he received ANS’s Mishima Award for outstanding contributions to research and development work on nuclear fuel and materials. In 2016, he was awarded ASTM International’s William J. Kroll Zirconium Medal for contributions to the field of zirconium metallurgy in the areas of oxidation hydriding, deformation, and radiation damage. His research interests center on the behavior of nuclear materials in the reactor environment, especially using state-of-the-art characterization techniques that include transmission electron microscopy and synchrotron radiation diffraction and fluorescence to discern materials degradation mechanisms in service. He has over 120 publications to his credit, including several reviews and book chapters.

Rick Michal, director of ANS’s Department of Scientific Publications and Standards, conducted this interview with Motta.

Light Water Reactor Materials, Volume I: Fundamentals is available through ANS and at Amazon.com.
Interview: Motta

to work with—people who are smart and knowledgeable, and who you can learn from. You try to maximize your chances of being with those people. Working with Don toward my doctorate was great, and I wanted to find more ways to work with him. This project was a way to do that and to continue to learn from him.

I want to mention that Don is an ANS Mishima Award winner for his contributions in the field of nuclear materials, especially in the area of fuel behavior, high-temperature chemistry, and the behavior of gases in solids. He also is an ANS Fellow and a member of the National Academy of Engineering, among many other distinctions.

How do you see student interest in nuclear engineering today?

At Penn State, students show great interest in nuclear, and we have the highest number of undergraduates in the United States, last year having graduated a full 14 percent of all the undergrads in nuclear engineering in the country. Although the Fukushima Daiichi accident caused a decrease of interest in nuclear in other countries, that doesn’t seem to have happened in this country as much. Although the industry faces strong headwinds, we hope that people will wake up to the fact that the plants are valuable assets that provide clean energy and contribute to a decrease in greenhouse gas emissions. If we shut these plants down, it will be because we are not valuing them properly.

From your experience, are students who graduate with undergraduate nuclear engineering degrees going for employment in the nuclear industry, or are they turning elsewhere?

In spite of the problems in the industry, there are still 100 nuclear power plants operating in the United States. There also is employment available at the Nuclear Regulatory Commission, the Naval Nuclear Laboratory, national labs, electric utilities, nuclear fuel vendors, consulting companies, and an assortment of other places. Many of the people who work in these places are like me—not too far from retirement, maybe 10 or 15 years away. So there is going to be a wave of retirements coming, and employees will need to be replaced. Even Westinghouse, which announced bankruptcy a few months ago, is still going strong. The company’s core business is still good, and it is still hiring.

When do you expect Volume II to be published?

Don and I are working hard at it. We have the initial version of it, and we have given our editor—Steve Zinkle, a nuclear engineering professor at the University of Tennessee—five chapters to review. We are very thankful for all the support we’ve gotten from the American Nuclear Society, especially its Book Publishing Committee, which reviews and approves books for publication, and the ANS staff who work hands-on to get a book published. We’re also very grateful to those nuclear engineering experts who have reviewed chapters and to the nuclear community for helping us out. Right now, our target for Volume II to be published is 2018. It is a goal that can be attained.

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